

**UNIVERSITY OF MAINE AT FARMINGTON**

**COLLEGE OF EDUCATION, HEALTH AND REHABILITATION**

**LESSON PLAN FORMAT**

**Teacher’s Name: Sara Turner** **Lesson #:** **3 Facet: Empathy and Perspective**

**Grade Level: 9-11 Numbers of Days: 4-5**

**Topic: Real world application of quadratic equations**

**PART I:**

**Objectives**

Students will understand that the quadratic equation can be applied in the real world

Students will know equation, variable, coefficient, constant, distribute, roots, parabola, quadratic, factoring, ax^2+bx+c, quadratic formula, order of operations, ball trajectory, distance, time, height, length, profit.

Students will be able to consider that a quadratic equation applies to the real world and analyze a quadratic in a real life situation.

**Product: Imovie**

**Maine Learning Results (MLR) or Common Core State Standards (CCSS) or Next Generation Science Standards (NGSS) Alignment**

**Common Core State Standards**

**Content Area**: Algebra

**Grade Level**: High school

**Domain**: Reasoning with Equations and Inequalities

**Cluster**: Solve equations and inequalities in one variable

**Standard** 4: Solve quadratic equations and in one variable.

**Rationale:**Students will be introduced to real world situations where they can use a quadratic equations. Students will know how to apply quadratic equations to real world situations.

**Assessments**

**Formative (Assessment for Learning)**

**Section I – checking for understanding strategy during instruction**

The teacher will observe students as they look at real life applications to ensure they are finding correct answers. The teacher will also use clickers to get instant feedback from the students to see if more time is needed on a particular topic.

**Section II – timely feedback for products (self, peer, teacher)**

The teacher will check in with each student and assess how they are applying quadratics to the real world. Students will also share their experiences with classmates to check each other’s progress

**Summative (Assessment of Learning):**

Students will work in small groups to create an imovie showcasing different real world applications for a quadratic equation. Students can also choose to create a photo album that shows different situations where students can use a quadratic equation.

**Integration**

**Technology (SAMR):**

The student’s use of Imovie or an online photo album is at the Modification level because of the use of multimedia in imovie, the sharing capability of the photo album, and the features each product has.

**Content Areas:**

**Music**- Students will be required to include some musical aspect to their Imovie or photo album.

**Groupings**

**Section I - Graphic Organizer & Cooperative Learning used during instruction**

Students will fill out a goal reasons chart to brainstorm ideas on how quadratic equations apply to the real world. Students will take part in a team discussion to further discuss real world applications.

**Section II – Groups and Roles for Product**

Students will work in small groups to create an imovie showcasing different real world applications for a quadratic equation. Students can also choose to create a photo album that shows different situations where students can use a quadratic equation.

**Differentiated Instruction**

**MI Strategies**

**Verbal:** Students will write down ideas they have about where quadratics can be found in the real world.

**Logic:** Students will need to think about where quadratics can be found in the real world.

**Visual:** The teacher will show pictures depicting different real life situations of where quadratics can be used.

**Musical:** Students will need to incorporate music with their imovie or photo album.

**Kinesthestic:** Students will be able to capture videos or pictures to help enhance their knowledge of quadratics.

**Intrapersonal:** The teacher will observe students as they work alone to assess their knowledge on real life application of quadratics.

**Interpersonal:** Students will work in small groups to compose imovies or photo albums to show case quadratics in the real world.

**Naturalist:** The teacher will provide real life situations involving things such as animals and nature where quadratics can be applied.

**Modifications/Accommodations**

***From IEP’s (Individual Education Plan), 504’s, ELLIDEP (English Language Learning Instructional Delivery Education Plan)****I will review student’s IEP, 504 or ELLIDEP and make appropriate modifications and accommodations.*

**Plan for accommodating absent students:**

If a student is absent at any point during this lesson, it is the students responsibility to check the teachers online website for what was discussed in class. If the student is absent on a day when the Imovie presentation is introduced the student must check the teachers online website and speak to the teacher about the presentation as well as check in with their partners. If a student misses more than one class during this lesson it is the student’s responsibility to check in with the teacher to ensure that they are understanding the material.

**Extensions**

**Technology (SAMR): Gifted Students:**

**Materials, Resources and Technology**

* Projector
* Graphing calculator
* Textbooks
* Worksheets
* Handout- Imovie and photo album instructions
* Handout- Garage band instructions
* Handout- Steps for each method of solving quadratic equations
* Different colored markers
* laptops for students
* Graphic organizer
* Hook occupation slips
* Print out of pictures from hook

**Source for Lesson Plan and Research**

<http://www.eduplace.com/graphicorganizer/-> A great website to find many different graphic organizers.

<http://cpm.sweetwaterschools.org/files/2013/02/Strategies-A-Z.pdf-> A list of multiple strategies to check for understanding from your students.

<http://www.ode.state.or.us/opportunities/grants/nclb/title_iii/5cooperative-learning-strategies.pdf-> Different cooperative learning strategies for teachers to use to help students.

<http://www.math.com/school/glossary/glossindex.html-> Website for mathematical vocabulary

<http://www.pleacher.com/mp/mlessons/calculus/appparab.html> A website that has some suggestions on where parabolas are found in real life.

<https://www.mathsisfun.com/algebra/quadratic-equation-real-world.html> Real life application of quadratic equations.

<http://classroom.synonym.com/everyday-examples-situations-apply-quadratic-equations-10200.html> A few more examples of real life applications.

<http://www.icreatemagazine.com/tips/how-to-create-a-movie-in-imovie-beginners-guide/> Instructions to creating an imovie.

<http://myalbum.com/> Online photo album students can choose to use for their project

<https://myalbum.zendesk.com/hc/en-us> Help for creating your online photo album

<https://blog.udemy.com/garageband-tutorial-a-beginners-guide-to-garageband/#5_1> Tutorial for garage band

**PART II:**

**Teaching and Learning Sequence (Describe the teaching and learning process using all of the information from part I of the lesson plan)***Take all the components and synthesize into a script of what you are doing as the teacher and what the learners are doing throughout the lesson. Need to use all the WHERETO’s. (1-2 pages)*

In the classroom, desks will be arranged in three rows of two facing the whiteboard. This will allow students to work with a partner easily when needed, and will also make it easy for the teacher to check in individually with students. The teachers desk will be placed at the back of the room to maximize privacy for students needing extra help, while also allowing the teacher to watch over all students.

**Agenda (include days and times)**

**Day One:**

Hook- Choose from fishbowl- discussion (10 minutes)

Further discussion on real life applications of quadratic equations (40 minutes)

Examples of quadratics in athletics (20 minutes)

Wrap up/ homework (10 minutes)

Assignment: Bring in 5 examples of where parabolas are found in architecture

**Day Two:**

Discuss what examples everyone found for homework (20 minutes)

Examples of parabolas in architecture (30 minutes)

Introduction of project and assigning groups (30 minutes)

Wrap up/homework (10 minutes)

Assignment: Start thinking about project and taking pictures

**Day Three:**

Meet with group for pair’s discussion on pictures that have already been gathered (20 minutes)

Imovie, photo album and garageband tutorial (45 minutes)

Decide which project your group will do, decide who is doing what in project (15 minutes)

Assignment: Work on project

**Day Four:**

Look at profit equations (30 minutes)

Work with group on projects (45 minutes)

Choose order for presentations for next class (5 minutes)

Assignment: Finish project and be ready to present

**Day Five:**

Meet with group (5 minutes)

Presentations (60 minutes)

Project survey (5 minutes)

Feedback from teacher on projects and what can be done for a better grade (10 minutes)

Assignment: Optional- proposal on what you will do for a better grade

**Teaching and Learning Sequence** (Include all hyperlinks of the above URL's in this section.)

Students will understand that the quadratic equation can be applied in the real world**.**

When you want to know the maximum height of a ball you've thrown, or the maximum speed of a car on a race track.   
*4: Solve quadratic equations and in one variable.*

The teacher will have slips of paper in a bowl that have different real life applications of quadratic equations. Students will take turns picking a piece of paper from the bowl and the class will then discuss how they think quadratics apply to the subject on the paper. The teacher will also ask if students can think of any applications.

**Where, Why , What, Hook Tailors:** Verbal, Logical, Visual, Interpersonal, Kinesthetic, Naturalist

The teacher will start a discussion with the students on where quadratic equations can be found in the real world. This will allow students to think about math in the real world and how it applies to the real world. It will also allow students to see that math is everywhere in the world because it can be seen all over the [world](http://www.pleacher.com/mp/mlessons/calculus/appparab.html). The teacher will go over any [vocabulary](http://www.math.com/school/glossary/glossindex.html-) that is necessary for the students. The teacher will start with examples of quadratics in [athletics](https://www.mathsisfun.com/algebra/quadratic-equation-real-world.html), such as throwing a ball, racing a car, or a ballet dancer. The teacher will also discuss quadratics in architecture and [profit](http://classroom.synonym.com/everyday-examples-situations-apply-quadratic-equations-10200.html) equations. The students will fill out [goal reasons](http://www.eduplace.com/graphicorganizer/) chart to brain storm ideas of where quadratics are found in real life. The teacher will sit with each student and [observe](http://cpm.sweetwaterschools.org/files/2013/02/Strategies-A-Z.pdf-) then when they are brain storming to ensure that they are grasping the idea and talk to them to get their ideas.

**Equip, Explore, Rethink, Tailors:** *Verbal, Visual, Logical, Interpersonal, Intrapersonal*

Students will be able to consider that a quadratic equation applies to the real world and analyze a quadratic in a real life situation. Students will work in a group to create an imovie or an online [photo album](http://myalbum.com/) that showcases where quadratics can be found in the real world. The teacher will also require students to incorporate music from garage band into their presentations. To start the project students will start to gather pictures for homework, and then take part in [pair's discussion](http://www.ode.state.or.us/opportunities/grants/nclb/title_iii/5cooperative-learning-strategies.pdf-) to go over the pictures. The teacher will take time in class for a tutorial on [imovie](http://www.icreatemagazine.com/tips/how-to-create-a-movie-in-imovie-beginners-guide/), [myalbum](https://myalbum.zendesk.com/hc/en-us), and [garageband](https://blog.udemy.com/garageband-tutorial-a-beginners-guide-to-garageband/#5_1). The students will have to work with their group to divide the work up equally and ensure that all members are participating. The students will be required to present their project and take a survey on how their group worked together. The students will be aware that not all students will receive the same grade if not all students put in adequate work on the project. The teacher will provide feedback for the students and a tentative grade. Students that wish to try to get a better grade must come up with a small project proposal, if the teacher ok’s the extra project students may be able to get a better grade on their work.

**Experience, Revise, Refine, Tailors:** *Verbal, logical, Visual, Kinesthetic, Interpersonal, Intrapersonal, Musical, Naturalist*

The teacher will have a rubric for the students presentation. This rubric will be filled out by the teacher while the students are presenting and will give students feedback with the rubric by the end of the class period. The presentation will be graded on the number of examples in their presentation as well as how unique their example are. Students will also be graded on their use of garageband. Students will know they may not receive the same grade as their partner. Students will also have the chance to do small sample of application for the teacher to increase their grade. Students will need to know how quadratics apply to the real world so they understand their real life application and so we can relate imaginary numbers in our next lesson to the real world.

**Evaluate, Tailors:** *Verbal, Visual, Logical, Interpersonal*

**Teacher Content Notes**

**Trajectory:** The path followed by a projectile flying or an object moving under the action of given forces.

**Architecture: T**he complex or carefully designed structure of something

**Profit:** A financial gain, especially the difference between the amount earned and the amount spent in buying, operating, or producing something.

The teacher will start a discussion with the students on where they think quadratics can be found in the real world. Examples can be in any form, whether it be a building, trajectory or finding a distance. The teacher will explore the student’s suggestions with the students and discuss the many possibilities of real life application. The teacher will show examples of applications in athletics, such as a ball being thrown or ballet dancer jumping. The teacher will show students how to calculate the distance and starting and ending heights. For homework the teacher will ask students to look at architecture and bring in 3-5 examples of where parabolas can be found in architecture.

The teacher will start a discussion about what students found for homework. The teacher will be sure that every students gets to share their ideas and all students participate in the discussion. After the class has gone over their thoughts and ideas on parabolas in architecture, the teacher will give specific examples for the students. The teacher will help students understand equations in architecture and will give some examples. The teacher will introduce students to their project and assign their groups. The teacher will show examples of projects for the students to get ideas. For homework the teacher will ask students to start thinking about their project and to start taking pictures for the project.

Students will meet with their groups for a pair’s discussion to go over their ideas and pictures they have taken for their project. The teacher will give a tutorial on imovie, garageband, and myalbum to help students with the project. Students will meet with their groups again to discuss their projects, make a plan of action and decide who is doing what and what route their project will take. For homework students will need start working on their projects.

The teacher will introduce profit equations and look at different examples with the students. The teacher will give real life applications and help students understand how they function. Once the teacher feels that the students have grasped the concept the rest of class will be used as work time for groups to work on their projects. At the end of class the teacher will draw names to decide the order of presentations for the next day. For homework the students will need to finish their project and be ready to present during the next class.

Students will have five minutes to meet with their group and prepare for their presentations. Students will present their projects while the teacher takes notes. After the presentations the students will take a survey about the project and how their group worked together. The teacher will provide a tentative grade for the students. If students would like to try for a better grade they can come up with a small assignment that will help raise their grade. For homework students will need to prepare a proposal for their assignment for the teacher to approve. This is optional for all students.

**Handouts**

* Instructions for imovie, photo album, and garageband
* Rubric for imovie and photo album
* Graphic Organizer
* Slips of paper for hook
* Project instructions

**Maine Common Core Teaching Standards for Initial Teacher Certification and Rationale**

***Standard 1 – Learner Development. The teacher understands how learners grow and develop, recognizing that patterns of learning and development vary individually within and across the cognitive, linguistic, social, emotional, and physical areas, and designs and implements developmentally appropriate and challenging learning experiences.***

***Learning Styles***

***Clipboard:*** *The teacher will have a website that has the class calendar on it that gives a brief overview of what was done in class. The any handouts given will be linked to the site as well as all homework assignments listed. Any and all assignment expectations or rubrics will be posted as well.*  
  
***Microscope:****Students will take part in daily in class practice giving them a chance for a deeper understanding of the material. This will also allow students to analyze how quadratic equations can be applied to the real world.*

***Puppy:****The teacher will ensure that students feel comfortable in the classroom. The teacher will encourage students to try to answer questions and will support students giving incorrect answers.*  
  
***Beach Ball:****A lot of this lesson is brain storming ideas about where quadratics can be found in the real world. The teacher will encourage and support students thinking outside of the box of where quadratics can be found.*

***Rationale:*** *This lesson incorporates many different aspects that allow students of different learning styles to best benefit from the lesson. By keeping the lesson diverse the teacher is able to help the most amount of students succeed.*

***Standard 6 -* *Assessment. The teacher understands and uses multiple methods of assessment to engage learners in their on growth, to monitor learner progress, and to guide the teacher's and learner's decision making.***

***Formative:***

**Section I – checking for understanding strategy during instruction**

The teacher will observe students as they look at real life applications to ensure they are finding correct answers. The teacher will also use clickers to get instant feedback from the students to see if more time is needed on a particular topic.

**Section II – timely feedback for products (self, peer, teacher)**

The teacher will check in with each student and assess how they are applying quadratics to the real world. Students will also share their experiences with classmates to check each other’s progress

***Summative:***

Students will work in a group to create an imovie or an online photo album that showcases where quadratics can be found in the real world. The teacher will also require students to incorporate music from garage band into their presentations. The students will have to work with their group to divide the work up equally and ensure that all members are participating. The students will be required to present their project and take a survey on how their group worked together. The students will be aware that not all students will receive the same grade if not all students put in adequate work on the project. The teacher will provide feedback for the students and a tentative grade. Students that wish to try to get a better grade must come up with a small project proposal, if the teacher ok’s the extra project students may be able to get a better grade on their work.

***Rationale:***

*These assessments allow the teacher to be sure that students are truly understanding the material. The assessments still take into account all different types of learning styles and allows all students to showcase their knowledge.*

***Standard 7* - *Planning Instruction. The teacher plans instruction that supports every student in meeting rigorous learning goals by drawing upon knowledge of content areas, curriculum, cross-disciplinary skills, and pedagogy, as well as knowledge of learners and the community context.***

***Content Knowledge:***

Students will know equation, variable, coefficient, constant, distribute, roots, parabola, quadratic, factoring, ax^2+bx+c, quadratic formula, order of operations, ball trajectory, distance, time, height, length, profit... (see content notes)

***MLR or CCSS or NGSS***

**Common Core State Standards**  
**Content Area**: Algebra  
**Grade Level**: High school  
**Domain**: Reasoning with Equations and Inequalities  
**Cluster**: Solve equations and inequalities in one variable  
**Standard** 4: Solve quadratic equations and in one variable.  
b: Solve quadratic equations by inspection (e.g., for x^2=49), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as a+-bi for real numbers a and b.

***Facet: Empathy and Perspective***

***Rationale:*** *Students will investigate where quadratic equations can be found in the world and how they apply to real life. Students will analyze these real world applications and understand their use.*

***Standard 8 -* *Instructional Strategies. The teacher understands and uses a variety of instructional strategies to encourage learners to develop deep understanding of content areas and their connections, and to build skills to apply knowledge in meaningful ways.***

***MI Strategies:***

**Verbal:** Students will write down ideas they have about where quadratics can be found in the real world.

**Logic:** Students will need to think about where quadratics can be found in the real world.

**Visual:** The teacher will show pictures depicting different real life situations of where quadratics can be used.

**Musical:** Students will need to incorporate music with their imovie or photo album.

**Kinesthestic:** Students will be able to capture videos or pictures to help enhance their knowledge of quadratics.

**Intrapersonal:** The teacher will observe students as they work alone to assess their knowledge on real life application of quadratics.

**Interpersonal:** Students will work in small groups to compose imovies or photo albums to show case quadratics in the real world.

**Naturalist:** The teacher will provide real life situations involving things such as animals and nature where quadratics can be applied.

***SAMR:***

The student’s use of Imovie or an online photo album is at the Modification level because of the use of multimedia in imovie, the sharing capability of the photo album, and the features each product has

***Rationale:***

Students will be able to showcase the application of quadratic equations in real life situations in a way that encourages creativity. Students should take advantage of the many effects and tools that imovie and myalbum have to offer to make their presentations come alive.

***NETS STANDARDS FOR TEACHERS***

**1. Facilitates and Inspire Student Learning and Creativity. Teachers use their knowledge of subject matter, teaching and learning, and technology to facilitate experiences that advance student learning, creativity, and innovation in both face-to-face and virtual environments.**

a. Promote, support, and model creative and innovative thinking and inventiveness

b. Engage students in exploring real-world issues and solving authentic problems using digital tools and resources

c. Promote student reflection using collaborative tools to reveal and clarify students’ conceptual understanding and thinking, planning, and creative processes

d. Model collaborative knowledge construction by engaging in learning with students, colleagues, and others in face-to-face and virtual environments

***Rationale:*** *a, b, c, d. Students will be brainstorming real life applications of quadratic equations on their own as well with other students. Students will need to demonstrate their knowledge with the use of technology. Students will also have the chance to reflect on their work and make adjustments as they wish.*

**2. Design and Develop Digital Age Learning Experiences and Assessments. Teachers design, develop, and evaluate authentic learning experiences and assessment incorporating contemporary tools and resources to maximize content learning in context and to develop knowledge, skills, and attitudes identified in the NETS-S.**

a. Design or adapt relevant learning experiences that incorporate digital tools and resources to promote student learning and creativity

b. Develop technology-enriched learning environments that enable all students to pursue their individual curiosities and become active participants in setting their own educational goals, managing their own learning, and assessing their own progress

c. Customize and personalize learning activities to address students’ diverse learning styles, working strategies, and abilities using digital tools and resources

d. Provide students with multiple and varied formative and summative assessments aligned with content and technology standards and use resulting data to inform learning and teaching

***Rationale:*** *a,b,c,d. Students will have the opportunity to research their own real world examples. Students will also be able to create their own presentation and make it as creative as they wish. The teacher will encourage students to take their own approach to their presentation to accommodate* *all learning styles.*